

THE UNO AVIATION MONOGRAPH SERIES

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**Fifteen Years of Collaborative Innovation and
Achievement: NASA Nebraska Space Grant
Consortium 15-Year Program Performance and
Results Report**

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Nebraska Space Grant
Consortium



15 Years of Collaborative Innovation and Achievement

NASA Nebraska Space Grant Consortium 15-Year Program Performance and Results Report

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Please reference the following acronym list for assistance in reviewing this document.

CALMIT	Center for Advanced Land Management Information Technologies	NAS	Nebraska Academy of Sciences
CAP	Civil Air Patrol	Native IMAGE	Native Institute for Managing Applications in Geospatial Extension
CSM	College of St. Mary	NICC	Nebraska Indian Community College
DFRC	Dryden Flight Research Center	NNAOP	Nebraska Native American Outreach Program
GES	Geospatial Extension Specialist	NSGC	Nebraska Space Grant Consortium
GIS	Geographic Information Systems	SASM	Strategic Air and Space Museum
GSFC	Goddard Space Flight Center	TAC	Technical Advisory Committee
GSRP	Graduate Student Researchers Program	UAO	University Affairs Officer
JPL	Jet Propulsion Laboratory	UNK	University of Nebraska at Kearney
KSC	Kennedy Space Center	UNL	University of Nebraska - Lincoln
LaRC	Langley Research Center	UNMC	University of Nebraska Medical Center
LPTC	Little Priest Tribal College	UNO	University of Nebraska at Omaha
MCC	Metropolitan Community College	UNTP	University of Nebraska Technology Park
NAC	Nebraska Aviation Council	USRP	Undergraduate Student Research Program

I. Executive Summary and Consortium Impact

Condensing five years of significant work into a brief narrative fitting PPR requirements gave the affiliates of the Nebraska Space Grant a valuable chance for reflection. Achievements of Space Grant in Nebraska were judiciously chosen for this document that best illustrate the resultant synergism of this consortium, keeping in mind that these examples are only a representation of greater activity throughout the state. Following are highlights of many of the finer and personal achievements for Nebraska Space Grant. The Consortium welcomes inquiries to elaborate on any of these accomplishments.

Impact of Space Grant on Nebraska, 1998-2002

One of the last states to join the national Space Grant network in 1991, Nebraska has developed from a Capability Enhancement state to a successful Designated consortium, having earned this distinction in the recent 2002 competition. Such a designation was the direct result of the consortium leading and elevating the state's national standing in aerospace research and education and provides validation of superior performance. This advancement was accomplished through consortium partnerships, the successful NASA Nebraska EPSCoR program (one of only two states to receive full funding under NASA EPSCoR 2000), and leveraging NASA resources to benefit Nebraska's citizens and industry within areas of NASA priority. Additional and significant leveraging results from 100% investment of NASA dollars into Nebraska programs. This is provisioned through our extraordinary waiver of all indirect costs.

Faculty researchers have capitalized on the Nebraska Space Grant Consortium (NSGC) seed research program. This program has fostered the development of faculty researchers in the state from nominal seed research funding to the successful leveraging of resources from federal agencies, non-profit organizations, state government, and industry. Developments are seen at the state's Technology Park in Lincoln where previous Space Grant-funded projects are now being commercialized through technology transfer. This economic development is crucial to the state's advancement.

Successful students in Nebraska are also making an impact on the state. Scholarships and fellowships continue to support the development of a workforce of future researchers. Nebraska is focusing efforts on established fellowship programs at the graduate level, as well as undergraduate researchers, especially during the first and second years through community college affiliates and two-year tribal colleges. These students contribute to the nation's workforce through the development of knowledge and skills to advance NASA's strategic missions. In all its activities, the Nebraska Space Grant Consortium directs its efforts and resources toward developing sustainable research infrastructure and enhancing the quality of science, technology, engineering, and math education for all Nebraskans.

Important and Significant Accomplishments of the Nebraska Space Grant

1. Significantly Contribute to the Diversity Efforts of the National Space Grant Program

Nebraska is committed to serving underrepresented and underserved populations in the state. One area of focus is Nebraska's Native American Outreach Program (NNAOP) which has earned praise from NASA. Faculty and staff of 4 Nebraska reservation schools, 2 tribal colleges, and 3 universities in the state collaborated to develop Families United in the Discovery of Mathematics, Science, and Technology (FUN) program. This program is consistent with NASA's directive to intensify relationships with Nebraska's Native American tribal colleges and schools. Dr. Thomas Pinelli of NASA Langley assisted in the vision of this program. The NNAOP also extends support to NASA educational opportunities for Native Americans such as Stargazer and teacher training provided by workshops held at NASA Ames and the EROS Data Center.

2. Assist Fellow Nebraskans through Geospatial Extension and Land Grant Applications

Nebraska strengthened Land Grant ties through collaboration with Cooperative Extension in the development of a NASA-funded Geospatial Extension Specialist and through continuing collaborative research and outreach ties with the Extension-funded Center for Advanced Land Management Information Technologies (CALMIT). Through these improved ties and through growing collaboration with the Minnesota Sea Grant Program, Nebraska serves the state workforce and economic development through training users in geospatial applications consistent with the Earth Grant Vision.

3. Place Nebraskans at NASA Centers for Workforce Development Opportunities

While academic skills and training are vital, the Nebraska Space Grant values motivating youth to pursue academic and professional careers relevant to NASA's workforce needs. To achieve this, Nebraska supports a number of programs designed to inspire youth academically and professionally in aerospace-related careers. These include NASA Academy students at NASA Goddard and NASA Ames, faculty and graduate student summer internships at NASA Langley, NASA Undergraduate Student Research Program (USRP), a graduate placement at NASA Kennedy, and student summer placements at JPL. The Nebraska workforce pipeline for NASA employees continues to grow at a rapid pace.

4. Serve and Participate in the National Space Grant Program as a Model Consortium

Nebraska Space Grant staff members serve the national program through various committee roles. Director Dr. Brent Bowen has served as Nominating Committee Chair for the National Council of Space Grant Directors since 2001 and continues to serve on the Committee on Grants and Contracts since 2000 for the Space Grant Foundation. Assistant Director Michaela Schaaf was asked to serve on the 15-year evaluation committee, as well as the national strategic planning committee. Additionally, Dr. Bowen was elected to lead the Aerospace Technology Enterprise Working Group, a model working group with many activities and outcomes to date.

Nebraska supports and participates in national initiatives such as the National Student Satellite Program, USRP, NASA Academy, Explorer Schools and others. Nebraska maintains its distinction as a model program through service and participation at the national level, as well as through the successful progress documented in the 10-year evaluation (first among Capability Enhancement states and fifth overall) and in Nebraska's promotion to Designated status.

5. Foster the Participation of All Nebraska Affiliates

Since the successful 10-year evaluation, Nebraska has seen a marked increase in the participation of all affiliates. Tribal college participation has been fostered through the Native American Outreach Program. Initiatives in seed research and higher education funding opportunities are driving participation from several community college affiliates. The statewide scholarship and fellowship program has seen an increase in the quantity and quality of applications. Additionally, new partnerships in outreach and research have been fostered through seed funding from Nebraska Space Grant resulting in new Center collaborations.

6. Provide Leadership in Aerospace Technology as a Topical Consortia

Nebraska is continuing its position of leadership in guiding the Space Grant's aeronautics efforts through the Aerospace Technology Working Group. Guidance for Nebraska's aeronautics focus is provided by NASA's Aeronautics Blueprint, ensuring that the NSGC remains aligned with critical NASA objectives. Center research mentors have inspired us toward many objectives realized in our aerospace technology-focused strategic plan. This strategic plan has been the key to our consortium's success and will be the focal point of the Introduction section of this report.

II. Introduction

Nebraska is a former Capability Enhancement state, awarded funds to make lasting impacts on research infrastructure and the quality of aerospace education throughout the state. Nebraska also strives to provide national leadership in applied aspects of aeronautics and aerospace technology as a topical consortium. The Nebraska Space Grant enhances the quality of life for Nebraskans through the continuous development of research, fellowship and scholarship funding, as well as public service via its 13 academic affiliates (listed on the signature page). The affiliates, which serve all geographic regions of the state, include a Carnegie Research I university; a comprehensive medical center; a women's college; 2 tribal and Land Grant colleges; a metropolitan university; and private, state, and community colleges and universities. Nebraska is committed to promoting and achieving excellence in the areas of student and faculty research, advancing education, and expanding outreach projects across the state. As an outreach effort, the Native American Initiative has been developed to extend opportunities to tribal communities and other members of rural Nebraska. Following the guidance provided by NASA, Nebraska consistently maintains a balanced program for the state, including scholarships and fellowships (29%), research (22%), education (16%), and public service (8%).

The Nebraska Space Grant Strategic Plan was originally derived from the 1996-2000 National Program Strategic Plan. To update the plan with the new workforce development focus, as well as the upgrade to Designated status, the Advisory Board members engaged in a strategic planning exercise in 2001 and 2002. This exercise was designed to facilitate discussion about goal prioritization of the Nebraska Space Grant for the next 5 years. Each board member ranked the strategic plan goals from most to least important in the state. The strategic plan was subsequently reorganized based on this prioritization. Additionally, board members engaged in a strategic plan facilitation exercise answering 2 questions: 1) *How can your institution assist in achieving each of these strategic goals?*, and 2) *What projects or activities can the Nebraska Space Grant undertake to achieve these statewide goals?*

Nebraska aligns with the national Space Grant Strategic Plan in all areas. The following section outlines Nebraska's approach to delivering a well-developed program that is consistent with state needs. The 7 cross-cutting strategic goals and objectives below illustrate the program's unique mix of elements which combine to emphasize NASA's priorities in the state.

Goal 1: Student Research Fellowship Program Deliver a scholarship/fellowship program that offers research opportunities to diverse student populations pursuing aerospace course work at participating academic affiliates throughout Nebraska.

Nebraska's research fellowship program provides funds for each academic affiliate annually and reflects the diversity of the Consortium's membership. The fellowship program emphasizes funding for women and minority students, especially targeting the 2 tribal college affiliates and 4 Native American public schools. Meaningful research placements are provided to awardees through internships, including those at the Nebraska Technology Park; research fellowships with faculty researchers; and through NASA and Center programs such as NASA Academy, SSEP, GSRP, USRP, SHARP, and Stargazer. To support funded students, Nebraska works to develop skills that contribute to the future workforce. This is accomplished through establishing faculty mentors, facilitating opportunities to work at NASA Centers (in addition to NASA programs), requiring students to present their research results at the annual Nebraska Space Grant research conference, and providing a Nebraska Space Grant Resource Center dedicated to these students.

Goal 2: Aerospace Research Raise the aggregate quality and quantity of Nebraska's aerospace/aeronautics research endeavors to the highest level of national competitiveness.

Nebraska places priority on research in the aerospace technology area, as well as research with direct application to the state of Nebraska. Through the statewide call for proposals encouraging all affiliates to participate, Nebraska ensures the fair and equal distribution of seed research funds throughout the state. The statewide peer review selection process places special emphasis on statewide balance and the development of junior faculty. Junior faculty development is fostered through travel grants allowing them to visit NASA Centers and establish collaborations with NASA researchers. This effort leads to cooperative scientific inquiry that contributes to NASA's strategic research and technology priorities. While visiting the NASA Centers, the researchers are also encouraged to meet with the Center UAOs to better coordinate the state Space Grant activities with the Centers. The overall goal of the seed research program is to grow research that contributes to the economic development of the state beyond Space Grant funding. Nebraska personnel assist in the identification of sources to continue the research after Space Grant funding ends, including industry outlets and the Nebraska Technology Park. Evaluation mechanisms for this program include the submission of quarterly reports, publication of research results in refereed academic publications, and presentation of results at the statewide Space Grant research conference in April.

Goal 3: Workforce Development Contribute to the state's aeronautics and aerospace workforce development by motivating talented Nebraska youth, and in particular those from underrepresented populations, to pursue post-secondary and graduate-level education and careers in aerospace science and industry.

Many strategies in NASA's Strategic Plan and those of its Enterprises focus on the development of a future workforce for NASA and its related industries. This workforce will need to possess the skills, knowledge, and motivation necessary to advance the long-term goals of NASA in Space and Earth Sciences, Biological and Physical Research, Human Exploration of Space, and Aerospace Technology Enterprises. Therefore, workforce development is a focus for many of Nebraska's efforts and has been elevated to its own goal in the Nebraska Strategic Plan. Increased efforts in this area include participation in the National Student Satellite Program through collaborative efforts with the Iowa Space Grant; aerospace career exploration activities, as funded through the Workforce grant; internship opportunities that promote aerospace-related careers, such as the Technology Park internship; and joint efforts with NASA Center personnel such as Mike Freeman (Kennedy) and Linda Rodgers (JPL) to arrange for placement of Nebraska graduates at NASA.

Goal 4: Geospatial Science Research Expand research, outreach, and public service activities in the emerging area of geospatial science through a Geospatial Extension Specialist.

The citizens of Nebraska face many environmental and social challenges that can be addressed with the help of geospatial technologies. Through the hiring of a Geospatial Extension Specialist in 2002, Nebraska is bringing expertise and training to users for help in addressing these needs. The cooperation with Land Grant and Cooperative Extension have benefited many Nebraskans to date. Geospatial data is now being utilized by tribal leaders in Nebraska and accessed by students at Geospatial Data Centers located at community and tribal Land Grant colleges. NASA collaboration in this area includes relationships with Blanche Meeson, NASA Goddard; Ramona Travis, NASA Stennis; and Mike Martin, Betty Sword, Hook Hua, and Steven Adams, the JPL personnel that transitioned the DataSlate server to Nebraska.

Goal 5: Public Service Activities Encourage and nurture a strong science, mathematics, and technology education base from elementary through university levels, with an emphasis on teacher training and delivery to underrepresented groups at the collegiate level.

Public service in the Nebraska Strategic Plan encompasses general public, pre-college, and higher education activities. These activities are linked by the statewide emphasis on teacher training programs and workshops that focus on science, mathematics, and technology education. Nebraska supports systematic improvement of math, science, and technology education in the state through the partnerships established with the College of Education at the University of Nebraska at Omaha (UNO). These leading faculty members work with NASA in the Earth Systems Science Education Alliance, incorporating NASA-developed technology into teaching tools for on-line delivery. Collaborations with non-academic affiliates foster rural and general public outreach through informal education channels. The Edgerton ExplorIt Center and the Strategic Air and Space Museum support informal education efforts through teacher workshops, and student and general public exhibits. A focus on underrepresented populations has grown over the past 5 years into the Nebraska Native American Outreach Program. This program includes aeronautics and geospatial education curriculum initiatives, as well as Family Science Nights at the reservation schools. These education programs are continuously evaluated by faculty from the School of Public Administration and the College of Education.

Goal 6: Technology Transfer Support technology transfer of NASA-funded research endeavors to Nebraska industry through ongoing program participation by key industrial and state leaders as well as effective implementation strategies.

Nebraska aggressively pursues technology transfer and relationships with industry. The establishment of the University of Nebraska Technology Park in Lincoln has furthered efforts in this area. The Advisory Board representative from the Technology Park hosted the December 2002 Advisory Board meeting at the facility, showcasing their capabilities to Space Grant researchers. The strategic plan calls for at least one aerospace-related business to be incubated at the park by May 2005. Collaborations have been established with the new College of Information, Science and Technology and the new business incubator in Omaha. Finally, Nebraska Space Grant will capitalize on a new state resource. Nearby Offutt Air Force Base, the new home of the U.S. Space Command, has expanded commercialization opportunities. This move positions Nebraska as a site for economic development, supplying the pipeline for the aerospace workforce.

Goal 7: Disseminating Materials and Funding Support national NASA programs through dissemination of promotional materials throughout Nebraska and provide funding opportunities for Nebraska participants.

Finally, Nebraska hired a Communications Specialist to further promote the Space Grant opportunities in the state and to report on the successful outcomes. The specialist works with Space Grant funded faculty to incorporate a public outreach component in their research. She has increased awareness of NASA programs and educational resources such as NASA Academy, USRP, GSRP, and the teacher resource centers. This strategy has resulted in more Nebraskans participating in national NASA programs.

III. National Program Emphases

Diversity

Nebraska's ethnic distribution is predominantly homogenous, with Caucasians constituting 89% of the general population (*Almanac of the 50 States*, 2003) and 88% of the higher education student

population (*Chronicle of Higher Education*, 2001). As a result, Nebraska has focused its diversity outreach toward encouraging women, racial minorities, and those with disabilities to actualize a more diverse workforce, particularly those seeking employment in STEM- and geography-related careers. This is evidenced in programs such as the Native American Rural Workshop, Native Institute for Managing Applications in Geospatial Extension (IMAGE), Native American Aviation and Aerospace Day, and Family Science, which have reached over 1,000 Native American Nebraska youth in the past 5 years. Outreach to the African American community is enhanced by the Tuskegee Airmen Internship Program. Nebraska is affiliated with several diverse institutions, including Little Priest Tribal College (LPTC), Nebraska Indian Community College (NICC), and the College of St. Mary (CSM), which primarily serves women. Several industry and government affiliates focus on diversity, such as the 99th Pursuit Squadron of the Civil Air Patrol (CAP), Alfonza W. Davis Chapter of the Tuskegee Airmen, and the Great Plains Girl Scouts.

Nebraska Space Grant's **Strategic Plan Goal 1** aims "to deliver a scholarship/fellowship program that offers research opportunities to diverse student populations pursuing aerospace course work at participating academic affiliates throughout Nebraska." This goal was not placed randomly as Nebraska's top priority. Efforts to further engage women, underrepresented minorities, and persons with disabilities are of the utmost importance. Nebraska's progress in this arena is evident, not only in the area of scholarships and fellowships, but throughout the state's program offerings.

Tremendous strides have been made toward involving women and minorities in research and outreach activities. Over the past 5 years, Nebraska added representatives from offices of multicultural affairs and student disabilities to its Technical Advisory Committee (TAC), in direct response to former Program Director Julius Dasch's recommendation. Valuable input from these participants led to improvements in program delivery. Nebraska TAC membership concurs with these recruitment and retention efforts and aids in the continued development of this initiative.

Competitiveness

Nebraska affiliates and contacts are encouraged to respond annually to seed research, education outreach, scholarship/fellowship, and travel grant calls. This aim is aligned with Nebraska's **Strategic Plan Objective 1.1** "to ensure the fair and equal distribution of funds to all academic affiliates through the minimum allotment of scholarship and fellowship funds for every academic affiliate each year" and **Objective 2.2** "to ensure the fair and equal distribution of seed research funds throughout the state."

During the past 5 years, Nebraska added program elements to parallel the competitive nature of the National Space Grant Program. First and foremost, input from Nebraska's TAC is continuously sought. Members are actively engaged in biannual meetings and are periodically updated via e-mail, listserv announcements, and postal mail. TAC members promote Space Grant at their institutions, thus encouraging submission of proposals and applications throughout Nebraska.

In 2001, upon recommendation from TAC membership, the scholarship/fellowship program was streamlined into a centralized, statewide application process. Scholarship forms are readily available via the Internet to all Nebraska students attending affiliate institutions. Applications are evaluated on a school-by-school basis; students from each school are ranked only against other students at their own college or university. To further ensure competitiveness, each pool of applicants is reviewed by at least 3 reviewers, among them the campus coordinator from that institution. Nebraska exceeds the recommended minimum applicant-to-awardee ratio (and the national average) by awarding approximately 1 award for every 4 applicants. Additionally, seed research, travel, and education outreach grants are promoted statewide through a multitude of channels. Announcements are sent to the STEM departments at each academic affiliate as well as to each institution's multicultural affairs, disabled students, ROTC, and financial aid offices. Applications are subsequently evaluated and

ranked by a panel of 3 reviewers similar to that of the scholarship/fellowship program. Rankings are determined and recommendations are reviewed by TAC membership, involving all affiliates.

NASA Ties

The TAC supports the Strategic Plan's emphasis on NASA ties which calls for facilitating "student opportunities to work at NASA Centers" (**Goal 1**), nurturing and supporting "productive collaborations between Nebraska researchers and NASA personnel, leading to cooperative scientific inquiry that contributes to NASA's strategic research and technology priorities" (**Goal 2**), and offering "travel grants to junior faculty to establish/strengthen ties with NASA Center researchers" (**Goal 2**).

To cultivate relationships at NASA Centers, Nebraska funded multiple internships and participated in several nationally-sponsored programs. Responding to NASA Headquarters' goal for Consortia to become better connected with NASA Centers, Nebraska maintains contact with each NASA Center University Affairs Officer (UAO). Travel grant awardees and administrative personnel visiting NASA Centers are required to schedule appointments with Center UAOs (**Goal 2**).

To align itself with the NASA pipeline initiative, Nebraska offers a variety of internship programs to engage faculty and students at Centers. Over the past 5 years, 1 faculty member and 6 students have been placed at NASA Centers. One example of the national programs Nebraska collaborates with is the NASA Academy program. Nebraska Wesleyan student Brook Weber participated in the 1999 NASA Ames Astrobiology Academy where she researched "Human Mood and Performance during Motion Sickness" with Dr. Charles DeRoshia. Nebraska also supported University of Nebraska-Lincoln (UNL) mechanical engineering student Mark Rentschler to attend the 2001 NASA Academy at Goddard Space Flight Center (GSFC). His final presentation, "MEMS Fabry-Perot Tunable Filters for Astrophysics, Solar System and Earth Science", was the result of research conducted with GSFC's Matthew Greenhouse and Richard Barclay. Going the extra mile beyond establishing these ties at NASA Centers through financial sponsorship of student participants, Nebraska is now working with Susan Miller to reinstate the NASA Academy at Dryden Flight Research Center (DFRC). Nebraska Director Dr. Brent Bowen is spearheading this initiative as Chair of the Aerospace Technology Working Group.

Nebraska's preeminent mechanical engineering department at UNL has produced students who fit well at NASA's Jet Propulsion Laboratory. Faculty mentor Shane Farritor, a Space Grant alum, sought Nebraska's support for several students to work at JPL; Erik Mumm and Gale Paulsen have worked with Linda Rodgers and her summer research programs.

Nebraska responded to the 1996-2000 Space Grant directive to work with NASA EPSCoR by supporting Nanette Metz's student internship and Dr. Scott Tarry's faculty internship at NASA Langley Research Center (LaRC). Metz completed a dissertation-driven study focusing on NASA's transition from the Advanced General Aviation Transportation Experiment to the Small Aircraft Transportation System (SATS). This enhanced Nebraska's NASA EPSCoR-funded SATS research. Another Nebraska EPSCoR seed research area, Spaceport Development and Commercialization, resulted in a funded fellow at Kennedy Space Center (KSC) and has strengthened ties between Nebraska and members of KSC, namely Rita Willcoxon, Cristina Guidi, and Mike Freeman. NSGC seeks new contacts in the area of commercialization inside and outside of the spaceport umbrella.

Industry Relations

The Nebraska Space Grant Strategic Plan **Goal 6** calls for supporting technology transfer through ongoing participation by key industrial and state leaders. Nebraska's new workforce development initiatives have led to growth opportunities in industry relations. Since the last Space Grant evaluation, the University of Nebraska Technology Park (UNTP) was established in Lincoln. It subsequently became a non-academic affiliate of the Nebraska Space Grant and has graduated 6

companies to date. Nebraska is confirming a memorandum of understanding with the UNTP, which will result in a formalized internship.

A lack of research and development in NASA-related industry within the state was cited as a challenge in Nebraska's last evaluation. In an effort to improve and further develop industry relations, Nebraska has included Valmont and 3-M representatives. New partnerships with contractors such as Northrop Grumman at Offutt Air Force Base are being actively pursued since the U.S. Space Command moved to nearby Bellevue, Nebraska. Geospatial networking includes the private Environmental Systems Research Institute in an emerging collaboration.

State Government Involvement

The Nebraska Geographic Information Systems (GIS) Steering Committee, established by the Nebraska Legislature in 1991, coordinates the implementation of GIS technology in the state. This committee ensures that public investment in GIS technology is achieved in a coordinated and efficient manner. The Nebraska Geospatial Extension Specialist (GES) participates on this committee and coordinates efforts with the 8 representatives of state government, 2 representatives from the Nebraska Association of County Officials, 1 representative from the League of Nebraska Municipalities, and representatives from the Nebraska Natural Resource Districts and Public Power Districts. Additionally, Louis LaRose, Planner for the Winnebago Tribe of Nebraska, works with the Nebraska GES (Nebraska Space Grant Strategy 4.1.2). Together they have completed a needs analysis for the tribe, collaborate on geospatial applications in bison herd management, and he has attended the EROS and CALMIT training sessions.

Nebraska Space Grant also has strong ties with Nebraska's State Department of Aeronautics (NDA). Director Kent Penney serves as an active advisory board member, regularly attending meetings and participating in the statewide review process for Nebraska's proposals. Nebraska and NDA have co-authored proposals together, including a successful proposal to the Research Triangle Institute and a proposal submission to the National Science Foundation. Although not funded, the collaborative effort exerted in authoring the NSF proposal was mutually beneficial and resulted in stronger coordination of aerospace activities with the state government. Fellowships provide an additional source of collaboration with state government. Nebraska provides fellowship funding to student interns at NDA and with the Nebraska State Patrol Aviation Wing. Additionally, Space Grant Director Brent Bowen has been appointed by the Lieutenant Governor to serve as the Nebraska delegate to the Aerospace States Association.

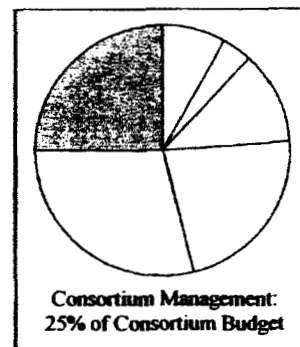
IV. Program Elements

A. Consortium Management

Description

Nebraska's support system consists of a unique, successful mix of researchers, educators, and administrators. The Director and Assistant Director (position added in 1999) assign tasks to the Program Coordinator, who works with all full-time staff and assistants. The Director is responsible for the implementation of the policies developed by the TAC and ensures that these policies are carried out on each campus by placing specific policy provisions within subcontracts and subagreements. Full-time staff includes a Technology Manager, a Staff Assistant, a Research Implementation and Communications Specialist, and a Geospatial Extension Specialist (GES). While these are all full-time, they may only be partially funded by Space Grant. This should be noted when referencing Nebraska CMIS Table III-B.

Decision-making, policy-making, self-assessment, and evaluation processes are governed by the Nebraska TAC, which serves as an integral part of the consortium's structure. Representatives from



across Nebraska are invited to participate in the development and evaluation of the state's funded programs. Members are formally engaged twice annually and are tasked on an independent basis to participate in consortium activities such as promoting program announcements, aiding in the distribution of press releases, and offering feedback and affirmation to reports.

Core Criteria

Consortium Operations

Over the past 5 years, NSGC has grown tremendously, resulting in hiring additional staff and acquiring additional office facilities at UNO. Nebraska's Director and Assistant Director work from offices provided in conjunction with their academic appointments. The specific Space Grant facilities consist of 4 separate offices. The primary office houses the Program Coordinator and Staff Assistant at UNO measures 156 square feet. In response to the Goldin Challenge presented by former NASA Administrator Daniel Goldin, Nebraska met each of the 43 guidelines established. This includes the directive to maintain a Space Grant office with 24-hour dedicated phone service. Office hours are clearly stated on the voicemail message. Callers have the opportunity to be directed to another line at the lead institution if staff are taking other calls or are away from the office. The second Nebraska office, also at UNO, houses the NSGC implementation team, while the third office houses the Nebraska Geospatial Extension team. The fourth office is the Space Grant Resource Center, which contains computer workstations, simulation software, and informational materials. An office also exists for the Manager of Technology.

The Nebraska Director's contribution to Space Grant averages 0.33 FTE. During 1998 and 1999 this is accurately reflected in CMIS; however, over the past 3 years, his FTE has been erroneously recorded in CMIS. The Assistant Director was hired in 1999 and contributes 0.25 FTE annually. This was recorded correctly in the 1999 CMIS report, but has since been erroneously reported. A full time Coordinator and Technology Manager contribute levels varying from 0.50 to 1.0 FTE. The Research Implementation and Communications Specialist, hired in 2001, is partially funded by NSGC. Each academic affiliate contributes approximately 0.10 FTE to help promote, execute, and evaluate Nebraska. See CMIS Table III-B for a tabular illustration.

Nebraska's Technical Advisory Committee (TAC) serves in a consultative and evaluative capacity. Campus coordinators from each academic affiliate, members of government and industry, and NSGC management staff constitute the board's membership. The TAC meetings cultivate successful collaborations among a variety of academic institutions and industry affiliates. Meeting outcomes allow NSGC and EPSCoR programs to strive for educational and research excellence. Over the past 5 years, the statewide network represented on the TAC has prospered and become more cooperatively aggressive. Additional TAC members, beyond those described within this document, represent the following organizations: 3-M Corporation, Grace University, Hastings College, Nebraska 4-H, Nebraska Department of Economic Development, Nebraska National Guard, Olsson Associates, and Western Nebraska Community College.

Resource Management

Nebraska consistently spends approximately 25% annually on management costs. This level of contribution remained consistent following Nebraska's upgrade from a Capability Enhancement to a Designated Consortium. Each year, matching funds exceed NASA funds for management. Nebraska's lead institution, UNO, provides the greatest amount of matching funds for the program. This is due to UNO's willingness to waive all indirect charges for maximum program investment. This is vital to resource management, as it allows all funds to be directed to programs. Funds are distributed among Nebraska affiliate members as a result of statewide research, outreach, and fellowship/ scholarship competitions. This excludes CALMIT, which was added in 2002 and will be allocated future funds. The statewide scholarship competition was adopted 2 years ago, per

recommendation of the TAC. Campus coordinators prefer to have all student applications sent to a centralized location. This eliminates multiple deadlines throughout the state and funnels all questions to the NSGC office. Campus coordinators promote the scholarship/fellowship program and participate on the statewide scholarship review committee. The results of this plan have been overwhelming, as the number of scholarship applications received has greatly increased.

Students and researchers from each institution are notified of funding opportunities and must submit all applications, on deadline, to the lead institution. Nebraska has developed deadlines that more effectively coincide with NASA's funding cycle. Seed research and outreach applications are due annually at the end of February. The annual student deadline was moved to April, which allows acceptance letters to be processed prior to the start of the fall semester. This also helps students who accept financial aid packages. In the past, students receiving additional forms of financial aid were negatively impacted by the prior award cycle. This problem has now been effectively addressed.

As stated earlier, Nebraska aims to keep its annual management costs at or below one-quarter of its funding from NASA. Through its successes in the delivery of quality education and research programs throughout Nebraska, NSGC continues to demonstrate the value of Space Grant to the state. In doing so, NSGC annually obtains an indirect cost waiver from the lead institution. Additionally, applicants are instructed that they may not charge indirect costs. Scholarship and fellowships do not require matching funds; however, they are welcome.

Nebraska prides itself in the balance of program elements achieved. Per NASA's guidance, emphasis is placed on the scholarship/fellowship element, according to the namesake of the Space Grant College and Fellowship Program. Seed research follows suit with this emphasis, to which approximately 22% of funds are dedicated annually. Nebraska also provides a number of higher education and general public programs. Finally, a small portion (an average of 4% annually) is dedicated to pre-college programs, in response to NASA Headquarters' directives. The allocation of funds across program elements may be viewed in CMIS table III-A.

Consortium Structure/Network (Internal)

Nebraska has 13 academic affiliates and 10 industry/government affiliates, including 6 universities, 2 state colleges, 1 college primarily serving women, and 4 community colleges (2 of which are tribal, Land Grant institutions).

One challenge for Nebraska is the incorporation of industry affiliates as the state does not have a strong industrial base of aeronautics/aerospace companies. Therefore, Nebraska has actively sought the inclusion of participants from related government/non-profit representatives from such sources as NDA, Nebraska Aviation Council (NAC), Nebraska Academy of Sciences (NAS), US Strategic Command (Offutt AFB, NE) and the Strategic Air and Space Museum (SASM). Nebraska's effort to strengthen ties to industry is evident in the recent addition of the Tech Park as a new affiliate. The movement of U.S. Space Command to Offutt Air Force Base is also providing avenues with new contractors in the area such as Northrop Grumman. In response to a directive from NASA Headquarters to become involved in the geospatial arena, Nebraska added CALMIT as an affiliate. Another aim is to better coordinate efforts with outreach organizations, such as Nebraska 4-H and the Great Plains Girl Scouts, both non-profit affiliates of the NSGC.

Each campus coordinator circulates flyers on campus, notifying all of funding and educational opportunities. Since the scholarship program became centralized, campus coordinators now focus more of their attention on promoting the program and recruiting students, researchers, and educators to the program. In addition to posting announcements on campus, campus coordinators are asked to post NASA contact information in their campus directories.

Nebraska is proud of its progress in this area, as achievement of diversity is among NSGC's top priorities. The TAC is composed of men and women from a variety of ethnic groups. The committee

consists of representatives from universities, military, and industry. The TAC boasts a diverse group of individuals representing African, European, Asian, Middle Eastern, and Native American cultures. In response to NASA Headquarters' recommendation, representatives from Multi-cultural Affairs and Services for Students with Disabilities were added to the TAC.

Nebraska has a strong network of communication. Information requests generated from the Director and Assistant Director are filtered through the Program Coordinator to the proper outlets, including the GES, Technology Manager, Staff Assistant, Research Implementation and Communications Specialist, and the Air Operations and Research Specialist.

To date, no academic affiliate has been dropped from the program. Should an affiliate fail to meet the requirements set forth, the status of the affiliate would be reviewed by the Director and the TAC. The resulting action could range from reduced to eliminated funding in future years.

Nebraska continues to focus on strengthening affiliate partnerships. The first step in the recruitment of a new academic affiliate involves reviewing the school's academic offerings. The Director is charged with evaluating the Nebraska science programs that are in need of further development. Next, the school is contacted and a meeting is scheduled to determine if the school is interested. An overview of the NSGC and the National Space Grant College and Fellowship Program is then presented. Institutions serving underrepresented minorities and underserved geographic populations have been given priority. Affiliate members work well together, as evidenced through the constructive feedback process executed in Nebraska's successful Designated Upgrade and Workforce Development proposals in 2002. New partnerships and collaborations have emerged across departments and institutions.

Each April, the spring TAC meeting is held in conjunction with the Space Grant Sponsored Aeronautics and Space Science Section of the NAS. This gathering serves as a research forum for all NSGC and NASA EPSCoR-funded researchers. The fall meeting engages the TAC in activities such as strategic planning, state aerospace needs, emerging areas of collaboration, and evaluation of progress. This meeting is typically held in late November or early December and serves as a progress update for the program. TAC members are encouraged to provide guidance and to volunteer to aid in the evaluation of proposals. Once proposals are evaluated, TAC members validate results.

Collaborations and Partnerships Outside the Consortium

Between 1998-2002, Nebraska funding resulted in 1,904 collaborations across all programs (CMIS Table II-A). While a majority of these synergies took place either at UNO or other higher education institutions, Nebraska touted 247 relationships with NASA Installations and Enterprises; 121 with nonprofit organizations; and 109 with organizations representing women, underrepresented minorities, or persons with disabilities.

Over the past 5 years, Nebraska has achieved great success in its 72 inter-consortia relationships. Collaborative meetings take place annually at the Minnesota Space Grant, leading to further interactions with that state's Space Grant and Sea Grant programs. Additionally in 2002, Nebraska co-hosted the Aerospace Technology Symposium with New Mexico at the NASA White Sands Test Facility. Collaborations also occurred with South Dakota and Iowa regarding Native American outreach. Iowa aided Nebraska in its inaugural Student Satellite launch.

As stated earlier, nearly 250 collaborations have taken place with NASA Centers and Enterprises. An outline of these relationships is listed in the NASA Ties section above. Much of Nebraska's success in this area can be contributed to Dr. Bowen's leadership as Aerospace Technology Working Group Chair since 1997.

Governmental and non-governmental entities are reached through the NSGC fellowship program. Fellowship funding is available to student interns placed at the SASM, NDA, the Omaha Police Department Air Support Unit, and the Nebraska State Patrol. Additionally, the following

entities participate as non-academic affiliates: NDA, NAC, NAS, Alfonza W. Davis Chapter of the Tuskegee Airmen, University of Nebraska Technology Park, 99th Pursuit Squadron of the CAP (minority chapter), Great Plains Girl Scouts, CALMIT, SASM, and Nebraska 4-H.

Impact/Results

Strategic Plan Goal 7 is to support national NASA programs by dissemination of materials throughout the state and providing funding opportunities for Nebraska participants. Affiliate members, funded researchers, educators, and scholars are linked effectively through electronic means, counteracting the negative implications of having a vast state with a largely rural population.

Nebraska TAC members and management staff work together in a mutually beneficial relationship. As a newly Designated state, Nebraska continues to award funds to develop research infrastructure, disseminate new advances in technology, enhance the quality of aerospace research and education, and develop geospatial utilization. Nebraska strives to improve the participation of academic affiliates, thereby increasing the NSGC's visibility and promoting opportunities.

B. Fellowship/Scholarship Program

Description

Purpose, Goals, and Objectives

Strategic Plan Goal 1 is to deliver a scholarship/fellowship program that offers research opportunities to diverse student populations pursuing aerospace course work at participating academic affiliates. Furthermore, **Objective 1.1** ensures the fair and equal distribution of funds to all academic affiliates through the allotment of scholarship/fellowship funds for every academic affiliate annually. This commitment is evident, as the largest portion of the Nebraska budget is dedicated to scholarships and fellowships.

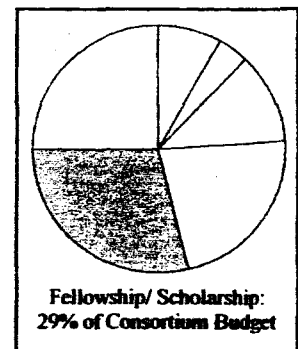
A successful fellowship program supports 3 general goals: (1) the program must promote research opportunities in the aeronautics and aerospace fields; (2) the program must provide a broader opportunity for underrepresented groups to participate; and (3) the program must offer a competition that allows all affiliates equal opportunity to compete for scholarship and fellowship funds. Nebraska works to meet these criteria by confirming the academic success of each participating student; increasing faculty mentorship, participation, and interaction with students; and providing greater research opportunities. Progress reports allow the fellowship administrator to determine whether or not academic success has been achieved and whether Nebraska academic standards have been maintained. These activities are tracked through monitoring student progress toward these objectives as they advance in the program. Additionally, specific fellowship information and applications are provided to each affiliate, which aids in collecting the most diverse group of applications available. An awardee database was developed in 2002 in an attempt to better track scholars and fellows.

A new e-mail outcomes assessment survey was designed and sent to all Nebraska awardees to track their progress. Providing an open opportunity for students to comment on their scholarship/fellowship experience, this inquiry gauged academic and career progress, interaction with faculty mentors, and funding issues. Nebraska looks forward to tracking the progress of newest scholarship program awardees: Max Kurz (UNO), Columbia Memorial Scholarship; and Brian Chamberlain, Native American Transfer Scholarship (LPTC alum).

Core Criteria

Diversity

The overall objectives of Nebraska's fellowship programs include actively attracting underrepresented groups and women toward research and education with an emphasis on aeronautics



and aerospace. This ultimately enhances the number of students pursuing aeronautics and aerospace-related studies.

Nebraska has exceeded the diversity objectives of the National Space Grant College and Fellowship Program regarding award distribution to underrepresented minorities. Between 1998 and 2002, 20.3% of Nebraska's awards were earned by underrepresented students

"Focus on involving women, underrepresented groups, and persons with disabilities in all aspects of education, including fellowship awards"
Space Grant Strategic Plan, 1996-2000

(CMIS Table II-B). Additionally, Nebraska's scholarship/fellowship awards to underrepresented students were at a 5-year low of 15% in 1999, and reached a high of 31.9% in 2001 (CMIS Table IV-A). According to the *2001-2002 Chronicle of Higher Education Almanac* Issue, only 6.5% of students enrolled in higher education in Nebraska were from underrepresented races (Native American, African, and Hispanic). In comparison to the entire population, only 10.3% of the population is from an underrepresented racial group (*Almanac of the 50 States*, 2003). Nebraska exceeds all benchmarks.

Diversity success is due in part to the well-developed relationship between Nebraska, LPTC, and NICC. **Strategy 1.2.2** is to develop a Native American transfer scholarship program. This program was underway at the end of the 2002 reporting period, with full implementation geared for 2003. This new program dovetails Nebraska's prior success in its underrepresented mentoring scholarship. Success is gauged via graduation and placement in industry or pursuit of advanced degrees. Additionally, Nebraska utilizes extensive marketing techniques (e.g. personal visits, direct faculty contacts, e-mail) to encourage women and racial minority students to apply for funding.

Nebraska has also achieved diversity success resulting from the funding of a specialist in the area of underrepresented minorities to enhance relations with Nebraska tribal colleges and reservation school districts. On a related note, a component of the Nebraska NASA EPSCoR grant is devoted to underrepresented involvement in aerospace/aeronautics research and education. Dr. Hank Lehrer has made great strides in this arena, including his direction of Native IMAGE at LPTC.

One of Nebraska's scholarship/fellowship challenges is the incorporation of females into its program. While 55% of Nebraska's higher education enrollment is composed of females (*Almanac of the 50 States*, 2003), only 43.8% of scholarships/fellowships were awarded to women from 1998-2002. Nebraska's awards of scholarships/fellowships to female students was at a 5-year low of 36.7% in 1999, but reached a high of 51.1% in 2001 (CMIS table IV-A). Numbers regarding female enrollment in STEM and geography programs of study were not readily available. It is theorized that enrollment of females in these degree programs has traditionally been lower. Nebraska continues to award half of its scholarships/fellowships to females (**Goal 1**). All benchmarks are exceeded.

Competitively Awarded Fellowships and Scholarships

Nebraska awards scholarships and fellowships to students pursuing aeronautics and aerospace-related degrees at participating affiliates. As a result of the newly attained Designated status, a minimum of 2 scholarships will be awarded annually to each participating affiliate provided a minimum number of applications are generated.

Nebraska promotes its activities to each affiliate through widespread dissemination of scholarship/fellowship materials to all aerospace and aeronautics-related departments (**Objective 1.1**). Traditional advertising at affiliate campuses includes posting flyers; delivering brochures to each department; and drafting statements for departmental newsletters, class announcements, and campus newspapers. Nebraska updates its website with deadlines, applications, and a frequently asked questions (FAQ) page. Additionally, announcements are sent to the listserv and previous applicants. This has resulted in the receipt of over 200 scholarship/fellowship applications each year.

Nebraska changed its application process at each campus to a centralized, statewide scholarship/fellowship program. Applications are collected at UNO. Each academic affiliate member is asked to review the applications from their respective school and the applications of students from up to 2

additional schools. Applications are then ranked and awards are made. Preference is given to students with research components and/or support from a faculty mentor. These fellowships and scholarships allow students to participate in a wide range of aerospace education and research activities, including the NASA Academies. Nebraska instituted the policy that a minimum of 3 applications should be received for every 1 award made. Nebraska's applicant to awardee ratio is 4:1 (CMIS table II-B).

Nebraska strives to ensure that all academic affiliates generate an appropriate number of applications. When this number is met, a base of 2 awards is presented, with additional funding opportunities based upon funding and quality of applications. CMIS table IV-B provides a statewide distribution of fellowship funding. This chart is skewed, showing that the majority of awards are made to UNO students. In reality, UNO serves as the scholarship/fellowship administrator for national programs such as the Native American Transfer Scholarship and Workforce Development Scholarship. Not all awardees from these programs attend UNO.

Graduate and Undergraduate Awards

Nebraska has a history of supporting graduate and undergraduate students. CMIS Table IV-A shows an average of 43 undergraduate awards each year, compared to an average of 15 graduate awards. While the undergraduate award averaged approximately \$1,250, the average graduate student awards were much higher at approximately \$3,000. The result is a balanced program meeting NASA objectives.

Student Research and Mentoring

Nebraska endeavors to enhance the mentoring aspect of the NSGC program. This is an important skill, particularly for undergraduate students. Nebraska requires each scholarship/fellowship recipient to attend, participate in, or lead at least 1 STEM-related or Space Grant event each semester. This fulfills the required service component of each award. Research or service components may include attending or presenting at conferences, promoting Space Grant in local schools, and mentoring other students, among others. If the student recipient does not attend an event during the semester, they are required to attend the annual Space Grant conference to learn more about NSGC research in the state. The Space Grant program is receiving increased publicity as a result of this requirement. Mentoring is also a significant element of the NSGC Hartmann undergraduate fellowship program in engineering.

"Emphasize awards with effective student research and mentoring components, for example, NASA Field Centers and industry." Space Grant Strategic Plan, 1996-2000

Student Research and Mentoring Components with NASA Field Centers and Industry

National program involvement has led to effective student research and mentoring at NASA field centers and with industry. Nebraska consistently promotes national programs at NASA centers, such as the Undergraduate Student Research Program (USRP), Graduate Student Researchers Program (GSRP), and the NASA Academies. Nebraska averages a successful application once every 2 years. In addition to national program involvement, Nebraska has established its own funded fellowship position at NASA KSC. Each student is mentored extensively by NASA personnel.

As stated in the NASA Ties section of this document, Nebraska aims to align itself with the NASA pipeline initiative by engaging faculty and students at NASA Centers through a variety of internship programs. Recent placements include JPL, KSC, GSFC, and LaRC. As mentioned earlier, several Nebraska students have been supported by NSGC funds to attend the NASA Academy. Each Academy students becomes integrated into the NASA workforce pipeline.

Impact/Results

Strengths and Weaknesses

NSGC provides maximum benefit to the state and NASA. The impact of Nebraska's scholarship/fellowship program has taken root within the state. The aging workforce, at NASA and overall, is a cause for great concern. Nebraska's goal is to engage recently funded fellows placed at

NASA Centers to serve as mentors for currently funded scholars and fellows, thus strengthening ties with alumni fellows. Future reports will track progress in this area.

Nebraska is proud of the quality of student effort and progress that has resulted from NASA fellowship funding. The new statewide scholarship/fellowship competition attracts a diverse group of applicants who are academically competitive with students throughout the nation. Students have gained valuable experience from programs such as NASA Academy and summer fellowships at NASA Centers. Nebraska seeks additional contacts at institutions where communication has been difficult. An additional focus is increased female participation in Nebraska's scholarship/ fellowship programs. Females constitute 51% of Nebraska's population and over 54% of higher education enrollments (*Almanac of the 50 States*, 2003). Nebraska, however, averages only 44% of its awards to females. It is assumed that STEM enrollments of Nebraska females are much lower than the 54% enrolled overall; however, this information was not readily available. Nebraska promotes these programs further to its academic affiliates' departments of women's studies and strives for stronger collaboration with CSM. Our awards to women substantially exceed the average number of women in science and engineering programs in the state.

Another Nebraska strength is the Space Grant Resource Center, a valuable tool for students (Goal 2 & 7). Fellows utilize the Center's computers, GPS simulations, CD-ROMs, resource periodicals, NASA and FAA documents, and NASA-developed software.

At the TAC's December 2002 meeting, members were engaged in revising Nebraska's Strategic Plan and providing suggestions for meeting stated goals. With regard to the student research fellowship program, board members suggested further engagement of academic affiliate Metropolitan Community College (MCC) for outreach purposes via the establishment of a geospatial data center. Another suggestion from the TAC was aimed at separating coursework and research scholarship/ fellowship applications. Applications were revised in 2002 to include research proposals and faculty mentor endorsement. This change will be presented to the TAC for further review prior to implementation. It was also suggested that meetings be facilitated with student researchers and that a poster session be mandated for all funded research fellows. Beginning in 2003, funded students were asked to document interaction with their faculty mentor. Also, students not making a verbal presentation at the annual research conference are encouraged to present a poster (Goal 1).

External Metrics to Measure Success

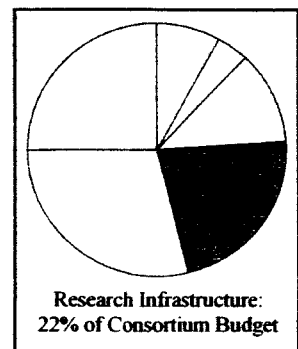
Nebraska student alumni are establishing themselves in the workforce. In 2002, Nebraska formulated a student alumni database to track alumni. However, no formal survey of program alumni has been conducted to track workforce placement. It is estimated that degrees were awarded to over 250 NASA scholars/fellows between 1998-2002. However, no information is available regarding the specific number of students who have continued pursuing higher degrees. Student fellow and scholar success may be measured in research outcomes and publications. Between 1998-2002, NASA scholars/fellows produced 39 publications (CMIS Table IV-A). With guidance from NASA, Nebraska will work to better track its scholars and fellows through the NASA pipeline to successful careers at NASA as well as with industry, government, and non-profit organizations.

C. Research Infrastructure Program

Description

Purpose, Goals, and Objectives

Nebraska directs its efforts toward sustainable research infrastructure for the state that is aligned with NASA priorities. Faculty members of all affiliate institutions are eligible to compete for enhancement funds that support initial



research funding and developing capabilities for Nebraska. These funds support conference attendance for presentations, travel to NASA Centers for collaborations, and mentorship of fellows in projects. Developing interdisciplinary research and the inclusion of junior faculty are priorities of the research program. Nebraska continues to modify and intensify its research priorities and related activities. In response to NASA's recommendation, Nebraska places greater emphasis on aerospace research and other research with direct application to the state.

Goal 2 seeks to raise the aggregate quality and quantity of Nebraska's aerospace/ aeronautics research endeavors to the highest level of national competitiveness. Nebraska places priority on research in the aeronautics area, as well as research with direct application to the state (**Objective 2.1**) and ensures fair and equal distribution of seed research funds throughout the state (**Objective 2.2**). Additionally, Nebraska encourages utilization of seed research support to identify and obtain additional sources of funding (**Objective 2.5**).

"Initiating research and increasing research capability are integral components of the national program"
Space Grant Strategic Plan, 1996-2000

Aerospace research in Nebraska is primarily driven by 4 doctoral-granting academic institutions in the state. Nebraska has made specific efforts to ensure that funds are more broadly distributed statewide. Since 1996, NASA Nebraska EPSCoR has required its researchers from major research teams to involve faculty from other affiliate institutions. This has resulted in more extensive participation in major research activities and has allowed faculty from Nebraska's smaller academic institutions to develop stronger research agendas. Research initiatives at LPTC and NICC are building on EPSCoR research and data collected at UNL.

Nebraska conducts an annual statewide competition for research funding (**Goals 2 & 7**). Each affiliate is eligible to apply. A statewide peer review process is used, comprised of a subset of TAC members. Priority is given to seed research in aeronautics. This focus has led to development of long-term research and education affiliations with NASA, FAA, and industry (**Goal 2**).

Along with aeronautics, Nebraska seeks "to expand research, outreach, and public service activities in the emerging area of geospatial science" (**Goal 4**). By hiring a GES, Nebraska geospatial-related community development and education outreach is expanding rapidly. This is accomplished through **Objectives 4.1** to develop a geospatial research project in conjunction with community members and educators on Nebraska's Santee reservation, **4.2** to expand the number of geospatial-related educational outreach and research programs, and **4.3** to develop an "extension presence" in the geospatial area.

Success is evaluated based upon subsequent proposals funded, publications generated, NASA collaborations established, and the impact on Nebraska's economy. Research success is measured by the number of publications, presentations, and proposals produced; other scholarly work such as monographs; contributions to further research; and overall contribution to the aerospace industry.

Support of National Space Grant Research Priorities

In accordance with Space Grants Research Priorities (1996-2000), Nebraska coordinates with NASA programs having similar objectives. This is accomplished through participation in EPSCoR and the USRP. Nebraska collaborates with NASA Center personnel through correspondence among Nebraska researchers and their contacts at Ames Research Center, DFRC, GSFC, JPL, Johnson Space Center (JSC), KSC, LaRC, John Glenn Research Center (GRC), Marshall Space Flight Center, Stennis Space Center, and NASA Headquarters.

A key component of NSGC's strategy facilitates collaborative relationships between NASA researchers and Nebraska faculty. Through **Objective 2.4**, Nebraska encourages development of relationships between junior faculty and NASA Center researchers and provides faculty awards for travel to Centers and Enterprise offices. Nebraska provides seed funding for the initiation of research and fosters the development of research throughout the state. These endeavors parallel NASA aims

and are driven by collaborative relationships between Nebraska and NASA, which are nationally competitive and offer near- and long-term potential to contribute to the state's economic growth. To achieve these aims, Nebraska has implemented strategies to engage promising faculty in NASA-driven research activity. Among these is an innovative approach to develop new research activity by junior faculty throughout the state. Nebraska awards small amounts of seed funding (on average <\$15,000) to researchers from academic affiliates to encourage new research or NASA collaborations.

Participation of Women and Underrepresented Minorities

Nebraska utilizes intensive marketing techniques to encourage women and minority researchers to apply for research funding and to participate in research activities. These techniques include personal visits, direct faculty/staff contacts, and e-mail correspondence. Efforts to support high-quality research endeavors have resulted in the sponsorship of a variety of noteworthy projects.

Through Native IMAGE, Nebraska has positioned itself for increased research collaboration with Native American faculty, staff, and students from LPTC. Another project involving Nebraska's Native American population is Lawrence Bradley's paleontological survey on the Santee Sioux reservation. Dr. Lynne Farr's research at University of Nebraska Medical Center [UNMC] (in collaboration with Dr. Lak Putcha at JSC) in circadian temperature acrophases and jet-lag is one example of a female-led project in Nebraska. Since 1998, the number of female research participants, both faculty and student, has increased steadily from 107 to 282 (**a 164% increase**) (CMIS Table V).

Core Criteria

Research Collaboration

Nebraska funded projects span a multitude of disciplines (**Goals 2 & 7**). Although the majority of these disciplines relate to aeronautics and geosciences, the entirety ranges from Cryogenic Rocket Propulsion to Remote Sensing of Cropland Agriculture. Nebraska supports research stemming from Aerospace, Aviation, Astronomy, Biology, Chemistry, Computer Science, Ecology, Education, Engineering, Geography, Geology, Mathematics, Nursing, Paleontology, Physics, and Rocketry, among others.

"Effective collaboration among faculty from colleges and universities with developing research infrastructure and persons from research-intensive universities, industries, and NASA Field Centers"
Space Grant Strategic Plan, 1996-2000

Dr. Shane Farritor, UNL Department of Mechanical Engineering professor, is truly a success story of the National Space Grant College and Fellowship Program. Dr. Farritor was a NASA Space Grant Fellow at the Massachusetts Institute of Technology before he was hired as an Assistant Professor at UNL. Dr. Farritor received Nebraska seed research funding to travel to JSC and identify NASA scientist collaborators (**Goals 2 & 3**). Additionally, Dr. Farritor submitted a proposal to the National Space Grant Steckler Competition (still pending) and had students conduct research at JPL in the summers of 2001 and 2002.

"Coordinate with other NASA programs having similar objectives - EPSCoR"
Space Grant Strategic Plan, 1996-2000

A joint remote sensing project between UNL, UNO, and Creighton University (CU) researchers encourages interdisciplinary and inter-institution cooperation, thus enhancing Nebraska's research infrastructure (**Goal 6**). As a result of this cooperation, Space Grant faculty authored a cluster proposal and won a NASA EPSCoR research grant. This led to additional funded research proposals, such as the NASA Stennis-funded Affiliated Research Center at UNL; and faculty, student, and curriculum development.

Enhancement of the library holdings is a priority for Nebraska (**Goals 7**). This support ensures that students and faculty have appropriate resources for research and curriculum development. In 1998, aeronautics resources in these holdings totaled 9,574 volumes, up from 5,000 in 1994.

Priority is given to projects that establish research collaborations with NASA scientists or Centers. Following the achievement of their stated objectives, these researchers are eligible for additional Space Grant funding. Since 1991, Nebraska has distributed over \$558,000 among its participating faculty. Approximately half of all seed grant recipients have subsequently received

NASA EPSCoR or other forms of NASA funding. Additionally, the GES Program is an important component of the national Earth Grant initiative among USDA, NASA, and NOAA.

Dr. George Gogos, a successful Nebraska researcher, graduated from Space Grant travel grant funding to NSGC seed research funding to NASA EPSCoR Collaborative Research Team status. His research project, "Validated Numerical Models for the Convective Extinction of Fuel Droplets," is guided by Dr. Vedha Nayagam (GRC) and involves 5 faculty and staff from 3 Nebraska affiliates (UNL, UNO, and NICC) and 2 students under GRC technical leadership.

NASA Strategic Enterprise Alignment

Nebraska encourages alignment with NASA Enterprises through the research funding selection process. Applications must directly support a NASA Enterprise, with preference to those that possess an established NASA collaboration (**Strategy 2.2.3**).

Impact/Results

Strengths and Weaknesses

Nebraska maintains high-quality research by requiring quarterly reports from each participant and encouraging reapplication of successful seed research projects. Innovative collaborations among NSGC affiliates have increased the aggregate level of research achievement. Nebraska focuses on production of high-quality outputs, as evidenced in the number of publications, presentations, and funded proposals produced from 1998–2002 (CMIS Table I-B). The total number of NSGC publications (46.8), funded proposals (6), and dollars from NSGC collaborations (\$3,496,535) all surpass the national averages.

The number of NSGC faculty researchers has increased since 1998. Specifically, the number of male faculty researchers increased from 39 to 105 (**a 170% increase**) and the number of female faculty researchers increased from 16 to 62 (**a 290% increase**). The number of student researchers has also increased since 1998. Specifically, the number of male student researchers increased from 73 to 181 (**a 148% increase**) and the number of female student researchers increased from 91 to 220 (**a 142% increase**) (CMIS Table V).

Nebraska recognizes the necessity of developing proposals with minority-serving institutions. Although such proposals have yet to be obtained through a Nebraska partnership, the opportunity is apparent. Past collaborations with LPTC on Nebraska's Winnebago Reservation have produced a wealth of research opportunities. Those include: (1) funded seed research for tribal college faculty; (2) development of workforce training and enhancement through the 2002 NSF proposal "Geoscience Education Opportunities on the Winnebago Indian Reservation" and, most pointedly, (3) the establishment of Native IMAGE on the LPTC campus.

Nebraska wishes to clarify the large number of research participants reported in CMIS between 1998 and 2002. Much of our research is viewed nationally and the reported numbers reflect this. Nebraska funds various high-profile activities including America's Virtual Farm, Airline Quality Rating research, and DataSlate, among others. These activities are well publicized in the media, and therefore, the numbers are accurate, as NSGC includes total media exposure/circulation.

Funded Research Activities

Nebraska-funded research activities contribute to the development and maintenance of the research capability of NSGC organizations and affiliates. This is evident in the quantity, quality, and diversity of seed research projects funded. Furthermore, Nebraska researchers utilize the outcomes of

Nebraska's Contributions to NASA Enterprises: A Selected Representation

Aerospace Technology

Small Aircraft Transportation System
Spaceports

Earth Science

Remote Sensing of Surface Waters & Wetland
Communities

Global Land-Ice Measurement from Space (GLIMS)

Biological and Physical Research

Leidenfrost Phenomenon Under Normal and
Microgravity Conditions

Microgravity Combustion Workshop

Human Exploration and Development of Space

Cryogenic Rocket Propulsion
Robotics for Human Mars Exploration

"Provide modest resources to initiate research opportunities in line with NASA Strategic Enterprises, especially among faculty who have not yet become established researchers"
Space Grant Strategic Plan, 1996-2000

initial NSGC seed funding to acquire additional grant funds through non-NASA sources, including funding from NSF, the National Institutes of Health (NIH), DEPSCoR, and the Nebraska Research Initiative. All 3 Nebraska EPSCoR Collaborative Research Teams (CRTs) initially received seed research money from NSGC. A CRT led by Dr. Don Rundquist originated with a \$15,000 seed grant in 1998. This funding led to a larger award through a 1999 NASA Preparation Grant, and ultimately to designation as a NASA EPSCoR CRT in the 2000 AERIAL initiative. Dr. Rundquist also received funding through NSF to support related research activities, providing substantial leveraging. This cooperation among federal, state, and local entities increased collaboration and identification of innovations to airborne technologies.

Various NSGC researchers have also successfully secured non-NSGC funding for continuation of their investigative work. Dr. Lynne Farr, Nursing Professor at UNMC, has secured funding from the Center for the Study of Cancer Biology, UNO, and the American Cancer Society. Dr. Neal Grandgenett secured funding from the NASA Earth Systems Science in Education Alliance, NASA, NebSat Program of Nebraska, and UNO. Additionally, Dr. Scott Tarry received funding from the Research Triangle Institute.

External Metrics

Between 1998 and 2002, Nebraska secured an annual average of \$73,628 in NASA funds allocated for research infrastructure-building initiatives. These funds supported projects focusing on cultivating collaborations, developing junior faculty, and intensifying research priorities. Nebraska submitted 68 research proposals in the last 5 years, 30 of which were funded; a 44% success rate. These proposals won an average of \$3,496,535 per year, a \$17,482,676 5-year total. Additionally, the number of Nebraska research publications rose from 28 in 1998 to 42 in 2002 (a 75% increase). Research funding for students rose from \$7,000 in 1998 to \$15,980 in 2002 (a 128% increase) (CMIS Table V).

Nebraska's efforts resulted in synergistic research activity that continues to benefit NASA's Strategic Enterprises and Centers, as well as the state (Goals 3 & 7). Specifically, these initiatives have resulted in 42 new or expanded collaborations with NASA; \$3,315,000 in non-NASA research funding; more than 465 undergraduate, graduate, and doctoral assistantships; and the development of several research-industrial collaborations in Nebraska, including the launch of several new in-state industrial efforts, such as the manufacturing of ellipsometers and a new airborne remote sensing business venture.

Research funds were allocated to Dr. Philip Craiger and doctoral student R. Jason Weiss to establish a base for conducting research using the Programmable Task Battery (Goal 2). This software, developed by Weiss, was designed for research into monitoring and control issues in semi-automated environments. It is a spin-off technology from the Multi-Attribute Task Battery developed by J. Raymond Comstock at LaRC. Finally, all faculty researchers or their student fellows are required to present at the Nebraska Space Grant Consortium Research Conference (Goals 2 & 7).

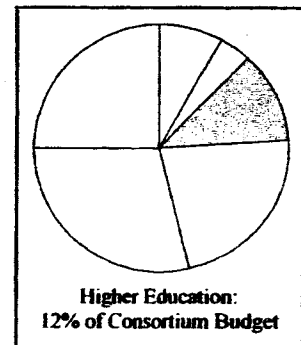
"Enhance research collaborations, mentorships, and other opportunities for faculty partnership with NASA Field Center personnel"
Space Grant Strategic Plan, 1996-2000

D. Higher Education Program

Description

Purpose, Goals, and Objectives

A key component of Nebraska's strategy regarding higher education encourages a strong STEM education base from elementary through university levels. Emphasis is placed on teacher training and delivery to



underrepresented groups at the collegiate level. This goal is consistent with the elements of NASA's Strategic Plan, Strategic Enterprises, and Implementation Plan for Education.

New partnerships and collaborations are sought at all educational levels of institutions, industry, and government (**Goals 3-7**). Each affiliate is encouraged to submit proposals for funding during the annual statewide competition. The review committee of the TAC considers education outreach proposals in the same fashion as research proposals, ensuring equity among affiliates, with each allowed only 1 vote.

Higher education objectives and initiatives are consistently analyzed by the TAC, which provides evaluative direction regarding NSGC's focus for all activities, products, and programs. To this end, Nebraska continues to focus the education component of the consortium on higher education programs. Those programs must be consistent with **Goals 3, 4, 5, and 7**. Funded programs include those that contribute to workforce development, relate to geospatial technologies, provide for curriculum support at higher education institutions, and disseminate NASA materials.

The distribution of all funding occurs on a competitive basis (**Goals 3 & 7**). Funded projects must be proven effective: Space Grant support is generally supplemental. This mutually beneficial relationship allows Space Grant more visibility for less cost and benefits programs now connected to NASA (**Goal 7**).

Support of National Space Grant Education Priorities

Nebraska's Strategic Plan reflects the higher education priorities of the national Space Grant program, specifically calling for workforce development (**Goal 3**). Related objectives include participation in national programs such as the Student Satellite program and support for NASA Center and industry internships. To this end, NSGC contributes to Nebraska's aeronautics and aerospace workforce development by motivating talented youth, particularly those from underrepresented populations, to pursue post-secondary and graduate-level education and careers in aerospace science and industry.

Goal 4 aligns with NASA's request to incorporate NASA-developed technology. Nebraska focuses on the area of Geospatial Science. This is accomplished through the placement of geospatial data centers at community colleges across the state and development of curriculum and training workshops for higher education faculty and students (**Goal 4**).

Goals 5 & 7 focus on public service activities and dissemination of materials. While these broad goals reflect objectives and strategies for elementary through university levels, Nebraska's emphasis is on higher education, including a focus on community college affiliates. Specific programs are described in the Core Criteria section.

The Earth Systems Science Education Alliance (ESSEA) on-line courses, which incorporate NASA-developed technology, are discussed in the Precollege Section also, as they focus on teacher training.

Recruitment of Underrepresented Groups

Nebraska targets women, underrepresented groups, and persons with disabilities for participation in all aspects of education, including fellowship awards, curriculum development, and degree programs. In 1997, the Nebraska Native American Outreach Program (NNAOP) was established to assist teachers in Nebraska's Native American community to encourage their students to achieve increased academic success (**Goals 3, 5, & 7**). NNAOP supports interactive extracurricular science activities that motivate students to achieve high academic standards in high school in order to successfully advance to higher education. NNAOP has earned praise from NASA researchers, such as Dr. Thomas Pinelli and Dr. Blanche Meeson (**Goal 3**).

"Develop instructional technology, technology transfer, and other technological courses that use emerging NASA-developed technology"
Space Grant Strategic Plan, 1996-2000

"Focus on involving women, underrepresented groups, and persons with disabilities in all aspects of education, including ... curriculum development, and degree programs in scientific and technical fields"
Space Grant Strategic Plan, 1996-2000

Native IMAGE provides geospatial data to colleges for educational purposes, equipping faculty/students with information on well-mapping, land-use, and precision agriculture. Native IMAGE provides GIS training and higher education endeavors such as shadowing and mentoring programs that expose LPTC and the Winnebago community to new technology (**Goals 3 & 5**). LPTC students now have access to a geospatial laboratory that offers GIS and remote sensing software, hardware, and equipment. Native IMAGE personnel organize geospatial workshops and coordinate the enhancement of LPTC's traditional and online courses.

Validation of the NNAOP

NASA Administrator O'Keefe stated in June 2002:
"Extending our reach to underserved and underrepresented communities is critically important to me and to NASA. . . . The challenge before NASA as well as our Nation is reaching out to those communities that have traditionally not been a part of such a mission and opening the door of opportunity to invite them to take part."

Core Criteria

Focus on Undergraduate Education

A continuing priority is curriculum development at LPTC and NICC (**Goals 3, 4 & 5**). After attending a NASA workshop on climate change, a NICC faculty member created a new course, which covers weather systems, climatic patterns, global warming, ozone depletion, GIS, and local consequences. This faculty member is collaborating with a Nebraska-funded UNL faculty researcher to develop an airborne remote sensing project on the Santee Reservation.

"Development of interdisciplinary courses and curriculum, including introductory courses designed for undergraduate students not majoring in scientific or technological disciplines"
 Space Grant Strategic Plan, 1996-2000

Nebraska recognizes that undergraduate education has become an increasingly important focus in university initiatives. Therefore, it is continuing to provide opportunities for undergraduate and graduate training and research activities throughout the NSGC academic affiliate network. Nebraska backed the development and operation of post-secondary distance education in aerospace and Geospatial-related fields, including Nebraska's first online undergraduate and graduate degree programs (**Goals 4 & 7**). Nebraska underwrites a portion of effort (.50 FTE) for a Manager of Technology who oversees the development of distance technology for these degree programs and assists affiliates in deploying similar technology. Fifteen students have graduated from the distance education program thus far. Nebraska also supported development of an online astronomy class for undergraduates, an education course on the teaching of science, and the ESSEA courses using NASA-developed technology. Nebraska places great value on new technology that enhances university-level aerospace curricula (**Goals 3, 5 & 7**). The research activities of NASA-funded faculty have resulted in the development of enhanced university-level curriculum. A collaborative effort is also maintained with the University of Nebraska at Kearney (UNK) to provide online courses needed for graduation.

In response to NASA's Strategic Plan (1996-2000) education priority regarding community college initiatives, Nebraska instituted geospatial data centers at NICC and LPTC (**Goals 3, 4, 5 & 7**). Future plans include a workstation at MCC.

"Develop community college initiatives, for example, high technology and distance learning projects, career retraining, and the development of new technical courses such as GIS, GPS, or automated mapping"
 Space Grant Strategic Plan, 1996-2000

Cooperative partnerships with informal education organizations include opportunities presented through the UNO Chapter of Women in Aviation, which provides national and local career exploration activities in aerospace for undergraduate and graduate students. Omaha's Chapter of the Tuskegee Airmen sponsors a local CAP chapter for economically disadvantaged youth and actively sponsors an undergraduate intern (**Goal 3**).

Interdisciplinary Collaboration and Cooperation

Nebraska supports the *Journal of Air Transportation (JAT)* and the *Aviation Institute Monograph Series (Goal 7)*, which are housed within the UNO Aviation Institute (an NSGC affiliate), and edited by its staff. This endeavor provides a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues.

Nebraska assisted CU researchers with developing hands-on RS teaching materials for use in Biology and Environmental Science courses that serve a large, diverse group of undergraduate science students (**Goals 3 & 5**). Through Nebraska's support, 2 software programs, Environment for Visualizing Images and RiverTools, are now utilized within the newly completed CU RS lab. This software allows students to view, manipulate, and interpret images during courses and research. Nebraska also supported the development of a new web-based course, Astronomy 1350, which was implemented during spring 2001 (**Goals 3 & 5**). Nebraska seed funding led to the development of a web-based astronomy laboratory. Future goals include expansion to the UNO Aviation Institute for use in its web-based courses.

Impact/Results

Strengths and Weaknesses

The impact of Nebraska's Higher Education Program is evident in the number of individuals who participate in its related activities. Specifically, Nebraska averages 514 participants per higher education activity (CMIS Table I-C). Furthermore, the number of activities and products developed and/or established through the NSGC Higher Education Program has steadily increased since 1998. Additionally, the total number of higher education publications that were produced from 1998-2002 by Nebraska, is 19.8, which far surpasses the national average (CMIS Table I-C). Most significantly, between 1998-2002, Nebraska's allocation for higher education programs rose from \$14,260 to \$187,706 (CMIS Table VI).

Nebraska is keenly aware that the total external dollars won as a result of NSGC funding, \$16,847, is under the national average (CMIS Table I-C). However, achievement in this area is evident. An increase has been seen in the number of dollars awarded from \$0 in 1999 to \$55,112 in 2002 (CMIS Table VI). We should clarify that achievement in our research areas has been significant and most of our external funding has been obtained through those research projects.

External Metrics

Between 1998 and 2002, Nebraska secured an annual average of \$41,666 in NASA funds, which were allocated for projects focusing on teacher training, community college objectives, and collegiate student research endeavors, among other educational opportunities. Additionally, Nebraska produced 99 publications from higher education programs, an average of 19.8 per year (CMIS table I-C). Additionally, over the past 5 years, the NSGC submitted an average of 2 proposals per year and won funding for 1 proposal annually, a **50% success rate**. The number of Nebraska activities and products has also increased. The number of curriculum development activities rose from 40 in 1998 to 79 in 2002 (**a 98% increase**) and the number of student and faculty development activities has risen from 90 in 1998 to 215 in 2002 (**a 139% increase**). Institutional development programs rose from 6 in 1998 to 15 in 2002 (**a 150% increase**). Most pointedly, Nebraska added 1 new Center, 6 new minors, and 32 new courses between 1998-2002 (CMIS Table VI).

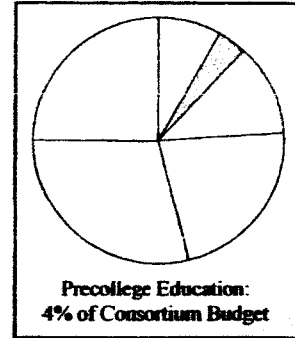
Nebraska also develops industry links in the state for workforce development. A partnership with the Tech Park is resulting in an internship program at the incubator businesses on site (**Goals 3 & 6**). Students from all Nebraska academic affiliates are eligible to apply. NSGC also supported the Niobrara Group Internship, which develops a Space Sciences industry in Nebraska by promoting collaboration between small businesses and educational institutions (**Goal 6**). This Group oversees the efforts of qualified interns in researching NASA Programs, establishing contact with NASA and JPL program managers and small business advocates, and investigating small business opportunities.

E. Precollege Education Program

Description

Purpose, Goals, and Objectives

Nebraska's Goal 5 encourages a strong STEM education base from elementary through university levels, with an emphasis on teacher training. Based upon NASA Headquarters' guidance, Nebraska allocates a small, yet substantive portion of its budget to precollege programs.



The TAC review committee considers education outreach proposals in the same fashion as research proposals, ensuring equity among affiliates. Funded programs must submit quarterly and annual reports to the lead institution as part of Nebraska's assessment and evaluation process. If a precollege program seeks additional funding, outcomes must be carefully cited and specific examples must be provided from the previous year.

Support of National Space Grant Education Priorities

"Enhance precollege teacher education (pre-service) programs through collaboration among education, science, and engineering disciplines"
Space Grant Strategic Plan, 1996-2000

Nebraska's Objective 5.1 is to "provide teacher training programs focusing on science, mathematics, and technology education." This is aligned with NASA's Space Grant Education Priorities as stated in the 1996-2000 Space Grant Strategic Plan. National aims include the placement of "emphasis on coordination with existing state and local systemic reform efforts and with state science, mathematics, and technology coalitions" and the formation of "cooperative partnerships with informal education vehicles such as science and technology museums, 4-H clubs, and forestry services." Nebraska has responded to this call by providing registration funds for teachers to participate in training activities.

One of many success stories was NSGC's role in the 2002 Nebraska Association of Teachers of Science annual conference. As Nebraska did not have a 2002 Solar System Educator (SSE), NSGC sponsored Kansas SSE Terri McManus to address 390 teachers at the conference. Nebraska staffed a booth at the conference, where science teachers received materials such as *PCs in Space*. NSGC materials were well received by these teachers. Nebraska's 2002 precollege participants (CMIS table VII) skyrocketed due to support of this conference. Each teacher was able to incorporate materials and knowledge gained into their classroom, thus impacting a greater number of students in alignment with Objective 5.1 to provide STEM-related teacher training. Additionally, teacher training was provided during summer 2002 at the SASM Lindbergh Teacher Workshop.

Participation and Recruitment of Underrepresented Groups

"Focus on involving women, underrepresented groups, and persons with disabilities in all aspects of education"
Space Grant Strategic Plan, 1996-2000

Underrepresented minorities are reached via Nebraska's precollege programs. Dr. Neal Grandgenett of UNO's College of Teacher Education targets EarthKam and Nebraska's Space Shuttle Simulator, *Maverick*, education programs toward inner-city, economically-disadvantaged, and underrepresented students. *Maverick* serves approximately 250 public school students and 30 teachers quarterly. This successful program is funded annually and has ties to NASA KSC.

Another means of outreach to Nebraska's Native American community is evidenced in the sponsorship of 2 students to attend the summer program, *Stargazer*, at Northern Arizona University. Native American students from the region are also invited to participate in Nebraska's Aeronautics Day at the Sioux City airport. Over 1,000 Native American students participate in this program, which introduces middle-school children to careers in aviation and aeronautics fields. Additionally, over 30 teachers have been trained in curriculum offerings of aeronautics and geoscience (Goal 5).

A variety of workshops are targeted toward increasing teacher education and training, such as the UNO Aerospace Education Workshop. This workshop primary serves female instructors throughout

the area. Most recently, teachers were able to incorporate lessons from the inaugural Nebraska Student Satellite launch into the classroom.

Core Criteria

Alignment with Nebraska's STEM Standards & Existing Nebraska Systemic Reform

Nebraska works extensively with local schools to support the curricular integration of national standards in STEM education. School districts are at various stages of aligning their curricula with these standards. Nebraska illustrated standards integration by modeling it as a clear theme in many educational outreach activities. For example, the Space Shuttle Simulation Laboratory has an extensive cross-referencing of STEM Standards within the 3-week curriculum unit undertaken by the teachers and students who visit this facility. Additionally, the Earth Systems Science Education Alliance online courses, which are facilitated by Nebraska, include a direct reference to these standards throughout course support materials. Finally, DataSlate, an award-winning software package that is distributed by Nebraska, includes 10 sample lessons for teachers that are closely aligned with national standards. In essence, Nebraska has become an extensively accessed resource to the districts across the state (and nation) in the development and review of standards-based educational materials. Several UNO professors are part of the consortium and help routinely review NASA materials for the Earth Systems Science Education and Space Education programs for their standards integration. All outreach activities are aimed at directly informing educators about standards-based teaching and learning while helping establish resources necessary to implement such pedagogy. Nebraska has engaged many exemplary retired K-12 teachers to help with these important and challenging leadership efforts.

"Place emphasis on coordination with existing state and local systemic reform efforts with state science, mathematics, and technology coalitions"
Space Grant Strategic Plan, 1996-2000

Emphasis on Teacher Preparation & Development

Nebraska's Strategic Plan aligns itself with the national plan by focusing on teacher training in STEM education. Many academic affiliates incorporate such training. Mr. Terry Gibbs of the Airway Science department at UNK has remained active in a variety of educational outreach programs throughout Nebraska. UNK hosted the 2002 Geography Educators of Nebraska precollege teacher workshop. NASA Earth Scientist Fred Brumbaugh presented at the Geospatial forum each day.

A variety of precollege activities have elevated teacher education including the Aerospace Education Workshop, Space Shuttle Simulator *Maverick*, NASA Consortium for the Application of Space Data to Education (CASDE), and CALMIT. Teacher training efforts include curriculum support and faculty preparation. Furthermore, Nebraska promotes rural and general education outreach through informal channels such as SASM, Bright Lights, and database distribution lists. Specifically, CASDE at UNL and the UNO College of Education collaborated on the Virtual Nebraska project. This cooperative extension CALMIT/NASA JPL program, spearheaded by former Nebraska Senator Bob Kerrey, promoted the use of space-derived, RS data and information. This successful endeavor preceded USGS the new AmericaView program. Focused on K-12 education, CASDE has accepted the challenge to make such data easily and intuitively available to teachers. Through forming curricular partnerships, the program matches the needs of educators with the data and tools of engineers and scientists. The goal is to integrate these data and tools into the educational process, as well as to provide easy access and appropriate technical assistance.

Nebraska further supports the work of Dr. Schulz of the Education Department at CSM, who along with the UNO Teacher Education Department celebrated the 10th anniversary of the collaborative Science, Math, and Relevant Technology (SMART) program. A joint venture with Girls Incorporated of Omaha, this program provides girls of varied ethnic groups in 1st through 7th grades with instruction in natural and social sciences, math, and technology. CSM students provide this

instruction and complete over 60 practicum hours within the SMART program. Finally, Nebraska has funded several tribal college instructors to attend summer workshops at NASA Ames.

Impact/Results

Strengths and Weaknesses

NSGC is pleased with its support of teacher training and related precollege programs in Nebraska. Nebraska is challenged with the promotion of its local and regional teacher resource centers. While no funding is provided from NSGC, Nebraska is interested in promoting available materials to students and educators. Nebraska will continue to examine external metrics to evaluate the success of funded programs. NSGC is already working with Nebraska's Explorer School and plans to participate in GLOBE. By partaking in national programs, impacts will be more effectively measured.

External Metrics

Precollege metrics are measured primarily against the objectives and strategies provided in the Nebraska and National Space Grant Strategic Plans. Nebraska's plan calls for the provision of a variety of workshops to increase teacher education and training (Strategy 5.1.3). This is achieved via the programs mentioned above. Mini-grants (Strategy 5.1.4) also support teacher training, as evidenced in the provision of funding to bring Kansas' SSE to Nebraska to train science teachers.

A portion of Nebraska's success in the delivery of precollege programs is evidenced by the dramatic increase in the number of total participants in such programs from 1998-2002. As CMIS table VII illustrates, Nebraska had 613 participants in 1998 and 452,030 in 2002. Designated status, which nearly doubled Nebraska's funding, more than quadrupled the number of precollege program participants from under 100,000 in 2001 to over 400,000 in 2002.

Nebraska Space Grant's Role in Promoting a Strong STEM Base in Nebraska

Finally, Nebraska continues to promote STEM education within the state by aiding in the sponsorship of a variety of workshops, conferences, and science fairs. Over the past 5 years, 86 such activities have taken place (CMIS table VII). As evidenced, through the recent Designated upgrade, Nebraska has expanded its K-16 education outreach efforts, particularly for the state's Native American population.

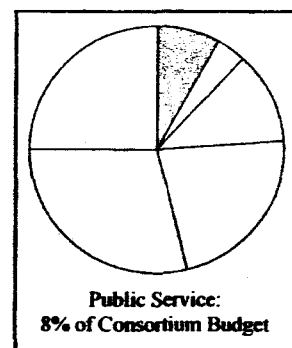
F. Public Service Program: General Public & External Relations

Description

Purpose, Goals, and Objectives

Nebraska's Goal 5 focuses on Public Service activities through Objective 5.3, which promotes rural and general public aeronautics/aerospace outreach through informal education channels. Nebraska receives proposals year-round; funding is based on alignment with NASA priorities. For example, former NASA Administrator Dan Goldin's visit to the UNO campus and his commencement address provided great visibility for Nebraska. Opportunities such as these are considered when proposed, and attempts are made for fair distribution of funds. Efforts to include and promote public service activities that target underrepresented groups are a priority.

Between 1998 and 2002, Nebraska averaged \$25,680 in NASA funds for public service activities (CMIS table I-C). These funds were allocated to projects focused on nurturing Nebraska's STEM education base. The purpose of Nebraska's Public Service program is twofold: (1) contributing to state needs through the expansion of research and public service activities in the emerging area of geospatial science via the hiring of a GES (Goal 4) and (2)



"Develop and implement a plan for establishing cooperative extension as a core Space Grant activity."
Space Grant Strategic Plan, 1996-2000

supporting national NASA programs by disseminating promotional materials and providing funding opportunities (**Goal 7**).

Support of National Space Grant Public Service Priorities

The implementation of a GES creates new opportunities for direct response and contribution to Nebraska's needs through the expansion of research and public service activities in the emerging area of geospatial science (**Goal 4**). Nebraska faces complex problems which can be addressed through the application of Geospatial data. The information age has the potential to change the agricultural landscape; therefore, Nebraska's GES is conveying pertinent aspects of geospatial technologies to producers and agribusiness personnel. The GES is developing an "extension presence" to assist our affiliates that are positioned to implement similar geospatial programs. Nebraska's GES is determining the best techniques to transfer the technology of products resulting from geospatial research in the state to public and corporate communities through applied research, demonstration projects, and educational programs. The GES develops linkages between academic programs, particularly Land Grant institutions, and commercial entities to yield economic development in Nebraska and contributes to workforce development through the implementation of continuing education credits, training, and workshops. NASA's Earth Science Enterprise Strategic Plan identifies objectives focusing on the development of RS technology. The Earth Grant concept furthers this goal by pooling efforts among NASA, USDA, and NOAA in applying geospatial data to Nebraska communities.

"Continue topical consortia devoted to the implementation of cooperative extension."
Space Grant Strategic Plan, 1996-2000

In supporting the Public Service Priorities of the 1996-2000 Space Grant Strategic Plan, Nebraska disseminates and promotes NASA-sponsored activities and opportunities via e-mail distribution, website enhancements, flyer circulation, and interactive presentations and provides funding opportunities for participants (**Goals 5 & 7**). This goal reiterates Nebraska's commitment to support the outreach goals of NASA's Enterprises and programs through the statewide dissemination of NASA educational products, promulgation of NASA's research and mission outcomes, and promotion of NASA-based fellowship opportunities. Through these activities, Nebraska facilitates the goals and objectives of NASA's Implementation Plan for Education.

Nebraska's Communications Specialist develops public relations materials that highlight the benefits of NASA research and the contributions of Nebraska researchers to NASA's programs, Centers, and missions (**Goal 7**). The Specialist enhances recruitment materials for Nebraska's scholarship/ fellowship program, NASA-based fellowship opportunities, and aerospace-related activities of affiliates and researchers. Additionally, she coordinates workshops for faculty on how to incorporate outreach into research initiatives.

Participation/Inclusion of Women and Underrepresented Groups

Nebraska has established Native IMAGE on the LPTC campus.

The infusion of GIS applications into Nebraska's tribal communities is a major deliverable of geospatial initiatives (**Goals 4, 5, & 7**). The educational goal of this project is to enable community members to utilize GIS. Native American school administrators, faculty, staff, and students, as well as academic partners at UNO and UNL, are playing significant roles in this educational endeavor. Native IMAGE supplies the Winnebago community with resources such as information on well-mapping, land-use, and precision agriculture.

"Stimulate public interest in aerospace sciences and lifelong learning through informal education partners."
Space Grant Strategic Plan, 1996-2000

The Nebraska Chapter of the Tuskegee Airmen is an affiliate. This group sponsors a CAP Squadron serving underrepresented, disadvantaged Omaha youth and works with area schools and the Great Plains Black History Museum. Nebraska support for this organization includes the provision of necessary office and meeting space and other needed supplies (**Goals 5 & 7**).

Core Criteria

Understanding of STEM Disciplines and NASA Missions Through Dissemination of Information

Nebraska operates a NASA information dissemination campaign through its website and its network of affiliates and researchers (**Goal 7**). The Technology Manager maintains this website which links to NASA Enterprises and Centers, the Space Grant College and Fellowship program, and other sites of interest related to aerospace, science, and aeronautics. The website contains information regarding NSGC and NASA activities, educational programs, and scholarship/fellowship opportunities. Active distribution lists notify affiliates, student organizations, and school districts of research, scholarship/fellowship activities, and special events.

A key Nebraska strategy requires all funded researchers to incorporate a public outreach component in their research that highlights NASA connections and related promotional materials (**Goals 5 & 7**). Researchers work with Nebraska personnel to develop educational materials. Nebraska incorporates NASA curricula into the classroom, including Blanche Meeson's (GSFC) geospatial educational materials.

Nebraska intensifies efforts to increase awareness of NASA connections and facilitates public access of NASA outreach and educational resources (**Goals 5 & 7**). Nebraska identifies additional markets for disseminating information throughout the state. Nebraska has built an alumni database, publicized placement opportunities, and provided participant scholarships to increase statewide recruiting efforts of summer programs at NASA, including the Summer High School Apprenticeship Research Program (SHARP), USRP, GSRP, and NASA Academy.

Stimulate Interest in STEM Disciplines and NASA Missions Through Program Activities

Nebraska promotes an understanding of STEM disciplines and NASA's mission through dissemination in a variety of ways (**Goal 7**). Specifically, endeavors such as Native IMAGE and Families United science, have increased the level of knowledge regarding aviation, aerospace, physics, computer science, chemistry, and mathematics among elementary and middle school-aged students, their parents, and families. STEM disciplines and NASA's mission are also promoted via the Nebraska website, newsletters, fact sheets, posters, flyers, brochures, e-mail distribution lists, informational CDs, publications, and presentations (**Goals 5 & 7**).

"Provide information and activities to increase public appreciation for the direct and indirect benefits of NASA-sponsored research."
Space Grant Strategic Plan, 1996-2000

Nebraska stimulates interest in STEM disciplines and NASA's mission through program activities such as NAS, the National EPSCoR conference presentations, the Nebraska Aeronautics Education Summit meeting, the 2002 Geospatial Workshop for Teachers, the "Successful Grant Writing for the GIS Professional" workshop, the University Aviation Association conference, UNO Aviation Institute Honors Convocation, and the Distinguished Guest Lecture Series (**Goals 5 & 7**).

Impact/Results

Strengths and Weaknesses

Nebraska's Public Service Program heightens interest in STEM disciplines and NASA's mission: this is evident in the number of individuals participating in such activities (6,700 in 1998 to 1,416,339 in 2002). (CMIS Table VIII). High levels of achievement are evident in Nebraska's 5-year average of 36.6 Activities/Products implemented from 1998-2002 (CMIS Table I-C). Nebraska funding for general public activities has risen significantly, from \$28,734 in 1998 to \$133,318 in 2002 (**a 364% increase**) (CMIS table VIII). This is attributed to Nebraska's participation in new public service opportunities, including Space Week, SASM events, and the 2003 National Engineers Week "Future City Competition," which was won by Mission Middle School students in Bellevue, NE.

External Metrics

Nebraska's Public Service Program impacts the development and maintenance of general public and external relations by NSGC and NASA. This is evident in the quantity, quality, and diversity of

funded projects and activities. External metrics illustrate the successes of such initiatives and dissemination techniques. Annually, Nebraska produces 5.2 posters, 6 exhibits, 3 television programs, 8.8 demonstrations, 2.4 articles, 2.3 press releases, and 10.8 training programs (CMIS table I-C).

Nebraska supports curriculum development, educational outreach, and workforce development activities by developing collaborations; providing funding, technical assistance, and distance learning technologies; and by identifying potential NASA resource materials. Funding for public service activities is available through the centralized, statewide grant review committee, with priority given to fair and equitable distribution of funds (**Goal 5**).

The FUN science program inspires Nebraska's Native American youth to pursue academic excellence and professional careers in aeronautics and aerospace fields (**Goals 3, 5, & 7**). The annual Aeronautics Day introduces Native American students to careers in military and civilian aviation. Nebraska researchers from UNL have developed research-related curriculum to present at Native American Family Science Nights. UNL students have prepared curricula sets in partial completion of their fellowship requirements.

Chadron State College Physics Department offers a variety of public seminars and informational sessions regarding the use of telescopes in astronomical research, which is partially supported by Nebraska (**Goals 5 & 7**). Nebraska also facilitates industry links in the state for the purpose of public relations and service (**Goals 3, 5, 6 & 7**). Initial efforts in this arena have proven effective, as a new partnership with UNTP is resulting in an internship program at the incubator businesses on site.

Nebraska's Community Internship Program enhances external relations with several non-profit and government organizations (**Goal 5**). Interns are placed with organizations such as NDA, SASM, the Omaha Police Department, and the Nebraska State Patrol Air Wing. Additionally, students and faculty members have been placed at JPL and LaRC for internship opportunities funded solely by the Space Grant program. Nebraska places more individuals each year by partnering with USRP, GSRP, the NASA Faculty Fellowship Program, the LaRC LARSS internship, and the AVSTO student competition internship programs.

V. Conclusion

This 15-year evaluation serves as a summary document highlighting the numerous and complete successes of the Nebraska Space Grant Program. Innovation has been highlighted through significant new endeavors during this 5-year period, such as placement of students and faculty at NASA Centers and the expansion of NSGC Native American Outreach Programs.

While the last national program evaluation resulted in Nebraska's ranking as the top Capability Enhancement Consortium, and 5th best overall, Nebraska felt there was room for significant growth and development. This has been validated through the recent competitive attainment of Designated Grant status and has allowed for the exploration of new initiatives, as well as the expansion of already successful programs.

A comprehensive strategic planning effort has involved all Nebraska representative entities and has guided Nebraska Space Grant through the evaluation period, providing a basis for continual advancement. Nebraska rigorously employs evaluation techniques to ensure that stated outcomes and metrics are achieved and that weaknesses are identified and corrected. With this coordinated approach, Nebraska expects that the next 5 years will yield new opportunities for significant achievement. Nebraska Space Grant will embrace new national endeavors, including the integration of Pender Public Schools – Nebraska's NASA Explorer School, geospatial initiatives, and the National Student Satellite Program.